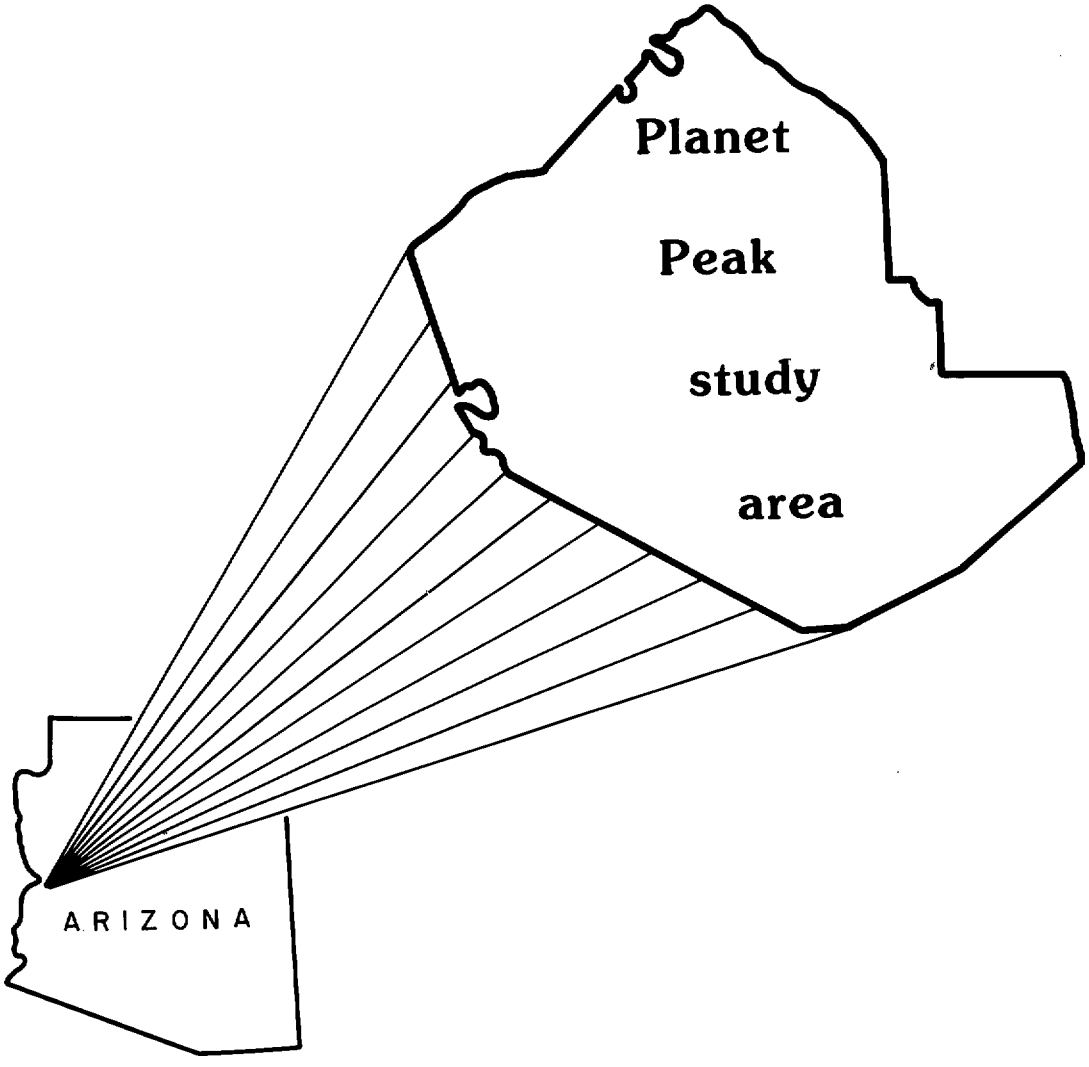
MLA 9-89

Mineral Land Assessment
Open File Report/1989

Mineral Investigation of a Part of the Planet Peak Wilderness Study Area (AZ-050-013), La Paz County, Arizona



BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL INVESTIGATION OF A PART OF THE PLANET PEAK WILDERNESS STUDY AREA (AZ-050-013), LA PAZ COUNTY, ARIZONA

by

Terry J. Kreidler

MLA 9-89
1989

Intermountain Field Operations Center
Denver, Colorado

UNITED STATES DEPARTMENT OF THE INTERIOR
Manuel Lujan, Jr., Secretary

BUREAU OF MINES
T S Ary, Director

PREFACE

The Federal Land Policy and Management Act of 1976 (Public Law 94-579) requires the U.S. Geological Survey and the U.S. Bureau of Mines to conduct mineral surveys on certain areas to determine the mineral values, if any, that may be present. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of a part of the Planet Peak study area (AZ-050-013), La Paz County, Arizona.

This open-file report summarizes the results of a Bureau of Mines wilderness study. The report is preliminary and has not been edited or reviewed for conformity with the Bureau of Mines editorial standards. This study was conducted by personnel from the Resource Evaluation Branch, Intermountain Field Operations Center, P.O. Box 25086, Denver Federal Center, Denver, CO 80225.

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LIST OF ABBREVIATIONS USED IN THIS REPORT

°	degree
ft	foot
in.	inch
mi	mile
oz/st	ounce per short ton
ppb	part per billion
ppm	part per million
%	percent

MINERAL INVESTIGATION OF A PART OF THE PLANET PEAK WILDERNESS STUDY AREA (AZ-050-013), LA PAZ COUNTY, ARIZONA

By Terry J. Kreidler, Bureau of Mines

SUMMARY

At the request of the Bureau of Land Management and under authority of the Federal Land Policy and Management Act of 1976, the Bureau of Mines conducted a mineral survey in February 1988 to appraise the mineral resources of 16,430 acres of the 17,645-acre Planet Peak Wilderness Study Area, La Paz County, Arizona. Prior to field study, Bureau personnel reviewed geologic literature and talked to several knowledgable people about mining and minerals in the area.

The study area is in a region characterized by low angle, extensional dislocation surfaces known as detachment faults. The Buckskin-Rawhide detachment fault cuts across the western part of the study area. West of the fault, on the hanging wall or upper plate, the rocks are chiefly Paleozoic-age carbonate rocks and Tertiary-age sedimentary rocks. East of the fault, on the foot wall or lower plate, the rocks are granitic gneiss, locally mylonitic. Gold deposits are associated with detachment faults at several localities in the Southwest.

No mineral resources were quantified at the surface in the study area; however, detailed exploration work in the Pride Mine area might define extensions, possibly into the study area, of the previously mined ore deposits. Trace element anomalies in samples from the study area indicate that mineralization similar to that which occurred at the Copperstone Mine (a newly operational gold mine 25 mi to the south) occurred in the study area, most notably at the Pride Mine.

Sand and gravel in the study area are not unique and thus are not valuable as a resource. The oil and gas potential is rated low to zero by the U.S. Geological Survey; the Arizona Bureau of Geology and Mineral Technology has not identified any prospective geothermal sources in the study area.

INTRODUCTION

In February 1988, the Bureau of Mines, in a cooperative program with the U.S. Geological Survey (USGS), studied the mineral resources of part of the 17,645-acre Planet Peak Wilderness Study Area, La Paz County, Arizona, on lands administered by the Bureau of Land Management (BLM), Yuma District Office. The Bureau studied the 16,430 acres designated as preliminarily suitable for wilderness. The Bureau surveys and studies mines, prospects, and mineralized areas to appraise reserves and identified subeconomic resources. The USGS assesses the potential for undiscovered mineral resources based on regional geological, geochemical, and geophysical surveys. The USGS will open file the results of its studies separately. A joint USGS-Bureau report, to be published by the USGS, will integrate and summarize the results of both surveys. This report presents the results of the Bureau's study.

Geographic and geologic setting

The Planet Peak study area is in northern La Paz County, about 15 mi east of Parker, Arizona (fig. 1). The northwestern boundary roughly follows the Mineral Wash Road. The southwestern boundary follows a segment of the Central Arizona Project canal and a transmission line; the southeastern and eastern boundaries are defined by an above-ground pipeline and the Planet Ranch Road, respectively. Access to the study area is via State Route 95 south out of Parker to Osborne Wash Road then east about 15 mi to Mineral Wash Road or 21 mi to Planet Ranch Road and then north on either road to the boundary;

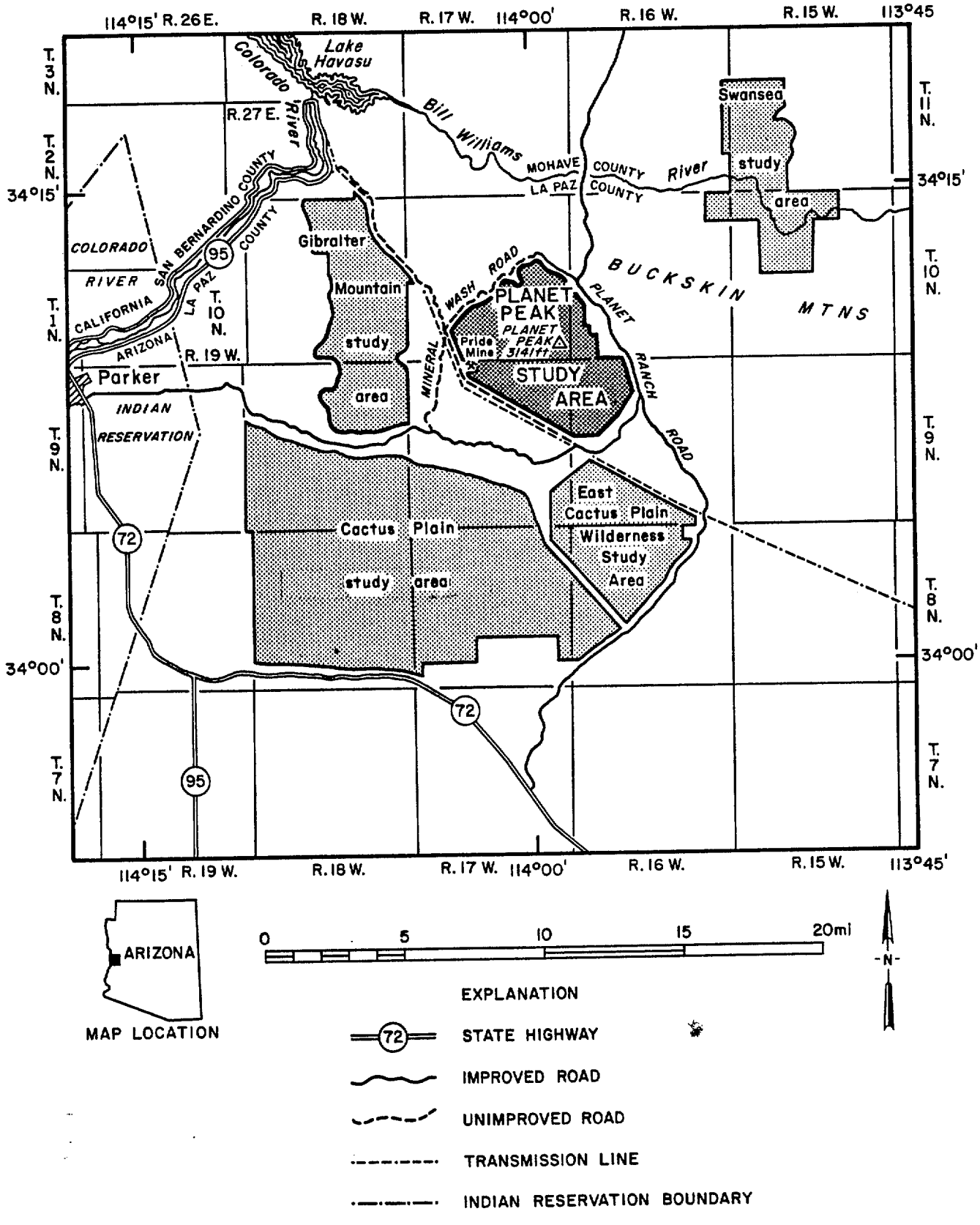


Figure 1.--Index map of the Planet Peak study area, La Paz County, Arizona.

access to the interior is by foot or pack animal. The study area is a few miles north of the Cactus Plain study area and East Cactus Plain Wilderness Study Area, which were previously studied by the Bureau (Kreidler, 1986; 1987). The Gibraltar Mountain study area, about 2 mi to the west, and the Swansea study area, about 6 mi to the northeast, are currently under study by the Bureau.

This part of Arizona receives about 4.5 in. of precipitation a year and temperatures over 100° F. are common during the summer months. Elevations in the study area range from 3,141 ft on Planet Peak to about 880 ft at the northern tip. Vegetation is sparse and consists mostly of cactus and desert grasses; the nearest source of water is the Bill Williams River about 2.5 mi to the north.

The study area is in west-central Arizona in the Sonoran Desert section of the Basin and Range physiographic province (Hunt, 1967, p. 310-312). This part of Arizona (and the contiguous part of California west of the Colorado River) is characterized by low-angle, extensional dislocation surfaces known as detachment faults with displacements on the order of several miles. The fault planes are undulating, nearly horizontal; thus the upper plate can erode away locally leaving the lower plate exposed in an erosional window (Reynolds, 1980). The Buckskin-Rawhide detachment fault can be traced across the western side of the Planet Peak study area, and on the eastern side, small pieces are exposed in the vicinity of Squaw Peak (pl. 1) (Spencer and others, 1986). Rocks to the west of the fault, or on the upper plate, consist of Tertiary-age sandstone and siltstone and Paleozoic-age carbonate rocks; to the east, on the lower plate, which includes most of the study area, they are mostly granite gneisses, locally mylonitic, of unknown age (Spencer and others, 1986).

Several gold deposits in the Southwest, including the Copperstone deposit about 25 mi south of the study area, are associated with detachment faults.

Previous investigations

The west-central part of Arizona has been the focus of much geological study in recent years due, in large part, to recent developments recognizing the relationship of precious metal deposits to detachment terranes. Reynolds (1980) discussed the geologic framework of this area and also summarized the previous work done to that time. "Mesozoic-Cenozoic tectonic evolution of the Colorado River region, California, Arizona, and Nevada" (Frost and Martin, 1982) gives a good overview of the state of knowledge concerning this area, and a paper in this volume by Wilkins and Heidrick addresses the region of the study area directly. The relationship of detachment faults to base- and precious-metal mineralization was studied by Spencer and Welty (1986); Wilkins and others (1986); and Lehman and others (1987). Spencer and Welty (1985) also described mineralized areas in west-central Arizona, including the Planet and Mineral Hill areas, north of the study area, and the Pride Mine area, along the southwestern boundary. As part of their assessment of the entire study area, the BLM contracted for an independent evaluation of mineral resources in the study area, based primarily on literature research (Wodzicki and others, 1982).

Method of investigation

Bureau personnel reviewed sources of minerals information including published and unpublished literature, Bureau files, and mining claim and oil and gas lease records at the BLM State Office in Phoenix. Discussions on the mineral resources of the study area were held with Chuck Botdorf, district geologist, BLM Yuma District Office and Pat Green, wilderness coordinator, at the resource area office in Lake Havasu City, Arizona.

Field work, completed in 26 employee-days, consisted of mapping (by compass-and-tape method) and sampling mines and prospects in and near the study area; 94 chip, grab, and select samples were taken. The samples were analyzed for gold and 33 other elements by neutron activation and for copper and lead by atomic absorption spectrometry by Bondar-Clegg, Inc., Lakewood, CO. Complete analytical data are available for inspection at the U.S. Bureau of Mines, IFOC, Building 20, Denver Federal Center, Denver, CO.

Mining history

The Planet Peak study area is included in two mining districts, the Santa Maria and Cienega; it is also near the Midway district (pl. 1). Table 1 summarizes the production history of the districts. The Santa Maria mining district produced gold, silver, and copper from ore occurring in massive to lensing replacement bodies of iron oxide in Paleozoic carbonate rocks of the upper plate. The Cienega mining district produced gold, silver, copper, and minor lead from replacement pockets in partially metamorphosed Paleozoic- and Mesozoic-age limestones, shales, and quartzites, which locally underlie

Table 1.--Summary of production data for mining districts in and near the Planet Peak study area, La Paz County, Arizona.

[All data from Keith, 1978. Gold and silver given in ounces, copper, lead, and zinc given in tons. Symbols used: Mn, manganese; na, not applicable]

District name	When active	Production data					
		gold	silver	copper	lead	zinc	other
Cienega	1880-1969	11,707	3,364	917	500	na	na
Santa Maria.	Intermittently since 1860's.	1,128	35,000	23,000	na	na	400 tons Mn ore.
Midway	Early 1900's-late 1970's.	45	35	4.5	na	na	na

thrusted Precambrian-age metamorphic rocks. The Midway mining district (about 1 mi southeast) contained gold, silver, and copper in spotty deposits along faults and fractures in Precambrian-age gneiss and schist and Paleozoic-age limestones. Mining in these districts took place within and adjacent to the boundary; however, the major production took place 2 to 3 mi north of the study area in the Mineral Hill and Planet Mine areas in the Santa Maria district. (See Keith, 1978.) As of February 1988, the mines within 5 mi of the study area were inactive.

As of January 1988, blocks of mining claims had been staked along the north and east sides of the study area in the Cienega mining district; all or part of about 36 claims were staked inside the studt area (pl. 1).

Energy resources

About 9,500 acres of the study area are covered by oil and gas leases (fig. 2). Ryder (1983, p. C19), however, rates the oil and gas potential of the study area low to zero because it is underlain by a thick sequence of metamorphic and igneous rocks that are not conducive to the formation of hydrocarbons. The leasing is probably a result of speculation that the hydrocarbon-rich overthrust belt, which contains large quantities of oil and gas in Wyoming, extends southward into Arizona (Keith, 1979, p. 10). All exploratory drilling in Arizona testing this theory has had negative results.

According to Witcher and others (1982), the study area has no known potential for geothermal resources; the nearest thermal well (130° F.) is about 4.5 mi to the northeast in Mohave County.

APPRAISAL OF SITES EXAMINED

Mineralization in the Planet Peak study area occurred primarily in three areas: the Pride Mine area in the southwestern part, along a spur ridge of

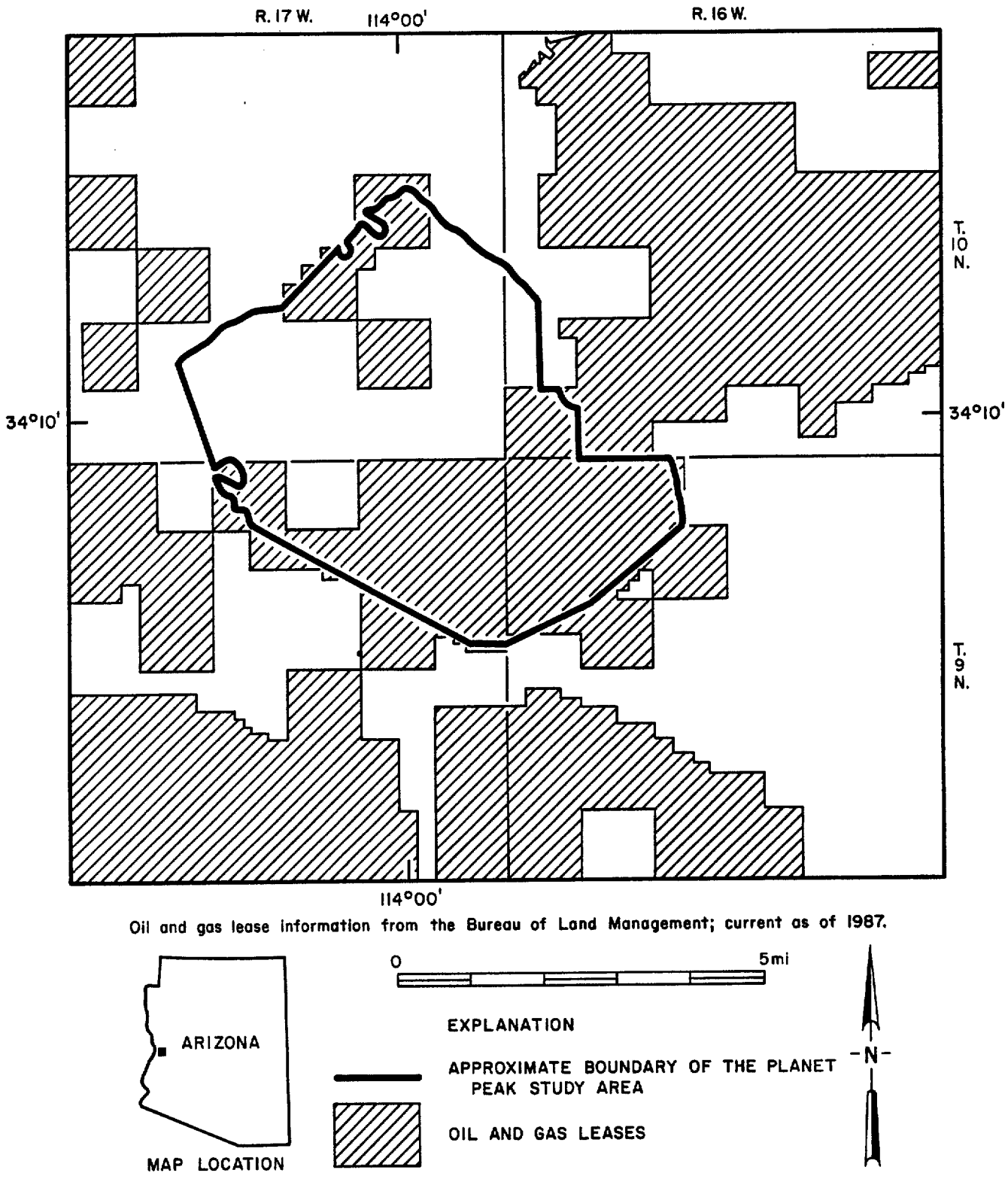


Figure 2.--Oil and gas leases in and near the Planet Peak study area, La Paz County, Arizona.

Planet Peak in the central part, and in the Squaw Peak area along the east-central boundary. In these areas, occurrences along fault zones contain veins, pods, and lenses of specular hematite and accessory copper minerals, primarily chrysocolla, malachite, and azurite coating fracture surfaces. Gangue minerals include mainly hematite, quartz, and calcite. The mineralized rock is discontinuous, often occurring as near-surface pods no thicker than 2 or 3 ft. The discontinuous nature prevented quantifying resources.

Pride Mine area

In the Pride Mine area (fig. 3), mineralization occurred primarily in two areas, at the Pride Mine and in an area about 1 mi southeast (fig. 3). Farther to the southeast, a third area of minor mineralization is defined by scattered prospects.

The Pride Mine, just outside the study area boundary in a "cherrystem," is on the Buckskin-Rawhide detachment fault (Spencer and Welty, 1985, p. 16-17) at an elevation of about 1,250 ft. The upper plate rocks consist of limestone of probable Paleozoic age, locally metamorphosed by movement along the fault; the lower plate is granitic gneiss, locally mylonitized, that underlies nearly the entire study area. Workings consist of two opencuts, an adit, two shafts, and a pit (fig. 3, nos. 5-13). The mine has been worked sporadically from the early 1900's, producing 40 tons of ore averaging 2.053 oz/st of gold, 0.158 oz/st of silver and 0.03% copper (Spencer and Welty, 1985, p. 4).

In the larger opencut (fig. 3, no. 5), a massive body of specular hematite is exposed over a horizontal distance of about 100 ft and vertically for 20 to 35 ft; abundant chrysocolla, malachite, and azurite coat fracture surfaces. The hematite appears to be a replacement body in limestone,

although the host rock has been so intensely altered as to make recognition of the original rock type difficult. The geology in the adit (fig. 4) and at the remainder of the Pride Mine workings is similar to this opencut.

Six of nine samples taken at these workings contained gold concentrations ranging from 11 to 150 ppb and averaging 56 ppb (table 2 and fig. 4). Average gold content for these rock types world wide is 4 ppb (Levinson, 1980, p. 872). Copper content is generally low, considering the abundance of copper minerals coating rock surfaces, ranging from trace amounts to 1.3%, averaging 0.66%; iron concentrations ranged from 3.2 to 49%, averaging 26%. Silver was not detected in any of the samples.

About 1 mi southeast of the Pride Mine, inside the boundary and at elevations between 1,200 and 1,300 ft, hematite and copper minerals occur in lower plate gneiss (locally mylonitic) and as near-surface pods and lenses, probably replacing carbonate rock xenoliths from the upper plate, and narrow veins along faults with dips ranging from vertical to about 10°. Limestone fragments are found locally in some fault zones.

These occurrences have been explored by means of several shafts and pits and one adit (fig. 3, nos. 14-31). The structures with low-angle dips are probably listric faults, a type of fault associated with detachment faults (Wilkins and others, 1986); the fault shown on fig. 5, with a dip of 14°, is most likely of this type. It is not known what relationship, if any, the high-angle faults have to the detachment fault.

Of the 18 samples taken in this area, 8 contain gold above the detection limit of 5 ppb, ranging from 6 to 350 ppb and averaging 51 ppb (table 2 and fig. 5, samples 14-31). This number is misleading as the one sample with 350 ppb skews the average; without it, the average gold content of the remaining

seven samples is 9 ppb. All but one sample contained copper above trace amounts, ranging from 0.02 to 1.5%, averaging 0.52%. Iron content ranged from 2.2 to 42%, averaging 17.3%.

South and east of the Pride Mine are several scattered prospects, shafts, and adits with mineral occurrences similar to those described above (fig. 3, localities 32-48). Samples taken at these workings contained gold (6-23 ppb), copper (trace-1.75%), and iron (5.1-62.7%) (table 2, samples 32-48).

Planet Peak area

Prospects in the Planet Peak area are inside the study area in the southeast 1/4 of sec. 36, T. 10 N., R. 17 W. (fig. 6). The workings consist of five pits and three short adits on a spur ridge on the southeast side of Planet Peak, at an elevation of about 2,200 ft.

Mineral occurrences consist of narrow hematite veins along faults and lenses and pods replacing slivers of carbonate rock from the upper plate, some contain secondary copper minerals. The fault zones have varying orientations and dips; fresh limestone occurs in one working and a highly altered mafic rock, possibly originally a diabase, in another.

Eleven samples (nos. 54-64) were taken in this area, five of which contained gold above the detection limit (7-20 ppb, averaging 12.2 ppb). The samples also contained copper (trace-3.76%, averaging 1.2%) and iron (1.9-58.7%, averaging 32.4%). (See table 3 and fig. 7.)

Squaw Peak area

Workings in the Squaw Peak area are less than 0.5 mi outside the study area boundary in sec. 31 and 32, T. 10 N., R. 16 W., at an elevation of about 1,600 ft (fig. 8), and are at the western end of a large group of prospects that stretch out across the desert for about 4 mi to the east (pl. 1).

Squaw Peak, underlain by the Buckskin-Rawhide detachment fault, consists of Paleozoic sedimentary rocks of the upper plate, primarily limestones, locally metamorphosed (Spencer and others, 1986). The workings are spread out to the northwest of Squaw Peak in the mylonitic gneiss of the lower plate. Mineral occurrences are hematite pods and lenses, and veins in faults with variable dips, striking between northwest and west (figs. 9 and 10). Chrysocolla and malachite are present locally. The discontinuous nature of the hematite veins is well demonstrated in the decline in fig. 10. At the surface, the vein is 6 to 12 in. wide. At the face of the first level (sample no. 84), the vein has pinched out. In the lower level (sample nos. 86-88), the vein has become lenticular pods separated by barren fault breccia. It is this characteristic of the mineralized areas in the study area that precludes quantifying any resources.

Of the 29 samples taken in this area (nos. 66-94), only 5, of which 4 are from the same mine, contained gold above the detection limit (9-24 ppb, averaging 13.2 ppb), 24 contained copper (0.038-4.08%, averaging 0.63%), and all contained iron (2.6-65.8%, averaging 28.7%) (table 4 and 5, fig. 9).

Miscellaneous workings

Table 6 summarizes the geology and sample data for several workings scattered across the study area. Mineral occurrences and geologic environments at these workings are similar to the previously discussed mineralized areas. Metal content of samples is also similar to the other samples.

Sand and gravel

Large deposits of sand and gravel occur in the study area but have no unique qualities to make them more valuable than the vast quantities that

blanket much of the desert in this region. Sand and gravel is a high-volume, low-unit-value material that must be located close to markets to be economic.

COMPARISON TO THE COPPERSTONE MINE

The Copperstone Mine (Cyprus Gold Co.) is about 25 mi southwest of the Planet Peak study area at the north end of the Moon Mountains in the hanging wall of the Moon Mountains detachment fault. The host rock is a thick sequence of foliated to massive quartz latite tuffs of Jurassic age cut by a northwest- trending breccia zone along a fault. The main ore horizon lies along the contact of the breccia and underlying quartz latite tuff. The gold occurs as small flakes ranging from 4 to 40 microns (0.00016-0.0016 in.); the most common gangue minerals are specularite, chrysocolla, barite, amethyst, calcite, and fluorite. (This geologic summary was taken from an unpublished report received from Cyprus on a tour of the mine in February 1988.)

Reserves are 6 million tons of ore with an average gold grade of 0.075 oz/st (2.57 ppm) that are currently (mid-1988) being mined by open-pit methods. An additional 1 million tons of ore at a grade of 0.17 oz/st of gold (5.83 ppm) has been blocked out for possible future underground mining (Bill Burton, Cyprus Minerals Co., personal commun., June 1988).

In table 7, geochemical data from the Copperstone Mine are compared with data from the Planet Peak study area and the average abundance of each element in similar rock types. Although the study area anomalies[1/] are not as high as in rocks from the Copperstone Mine, samples from the study area contain higher concentrations of the specified elements than is the norm for these rock types (except for lead, in which the study area samples are notably

1/Any elemental concentration over two times the average concentration for that rock type is considered an anomaly.

Table 7.--Comparison of geochemical data from the Planet Peak Study Area and Copperstone Mine, La Paz County, Arizona.

[Detection limits: gold (Au), 0.005 ppm; arsenic (As), 1 ppm; barium (Ba), 100 ppm; chromium (Cr), 50 ppm; copper (Cu), 1 ppm; iron (Fe), 0.5%; lead (Pb), 2 ppm; antimony (Sb), 0.2 ppm. Symbols used: <, less than detection limit; nd, no data. Number in parentheses beneath each element value is number of samples the average is based on.]

Area	Au	As	Ba	Cr	Cu	Pb	Sb	Fe
	ppm							%
Copperstone 1/	2.9	11.0	3,300	48	2,000	24.0	1.5	6.7
Pride Mine	.056 (6)	9.2 (9)	510 (8)	76 (1)	5,935 (9)	6.3 (9)	.6 (9)	26.0 (9)
Sec. 4, T. 9 W., R. 17 W.	.009 (7)	7.0 (18)	647 (16)	70 (8)	4,934 (18)	3.2 (5)	.5 (5)	17.34 (18)
Sec. 3, 9, 10, T. 9 W., R. 17 W.	.012 (7)	3.7 (17)	1,111 (12)	148 (3)	3,442 (17)	3.3 (8)	.3 (9)	22.68 (17)
Planet Peak	.012 (5)	2.3 (8)	987 (3)	<50 (11)	10,544 (11)	3.0 (2)	.4 (11)	32.45 (11)
Squaw Peak	.013 (5)	4.3 (28)	3,443 (23)	197 (8)	5,050 (29)	9.8 (26)	.7 (25)	28.81 (29)
Average all Planet Peak samples.	.0295 (37)	4.6 (89)	1,608 (76)	128 (23)	5,938 (94)	7.6 (62)	.5 (67)	24.37 (94)
Average for similar rock types.	.004	2.0	500	2	20	20	.2	nd

1/ Average element anomalies from Copperstone samples, data supplied by Bill Burton, Cyprus Minerals, June 1988.

deficient). These anomalies indicate that the study area has been subject to mineralization similar to that which created the Copperstone ore body. The higher concentrations of gold, however, occur only where the ground has been

adequately prepared by faulting or where more reactive rock types occur. At the Copperstone Mine, the fault breccia provided a conduit system for the circulation of hydrothermal fluids and deposition of mineral deposits. In the study area, the limestone and metacarbonate rocks of the upper plate, which have been eroded from all but a small part of the study area supplied reactive rocks for replacement. The Pride Mine area has the largest outcrop of carbonate rock in the study area and thus the greatest likelihood for the occurrence of ore deposits. The area would have to be explored in detail to determine if ore is present.

CONCLUSIONS

With the possible exception of the Pride Mine, none of the mineralized areas in the Planet Peak Study Area contain mineral resources. A detailed exploration program, including geologic mapping, geochemical and geophysical work, drilling, and trenching would be required to determine if any resources exist at the Pride Mine. The large deposits of sand and gravel that occur in the study area have no unique qualities to make them more valuable than those that cover vast areas of the desert in this region, and thus are not likely to be developed. The area has been rated as having low to zero potential for oil and gas because it is underlain by crystalline rocks. The area has no evidence for geothermal resources.

REFERENCES

Frost, E. G., and Martin, D. L., eds., 1982, Mesozoic-Cenozoic tectonic evolution of the Colorado River region, California, Arizona, and Nevada; the Anderson-Hamilton Volume: San Diego, California, Cordilleran Publishers, 608 p.

Hunt, C. B., 1967, Physiography of the United States: San Francisco, W. H. Freeman and Company, 480 p.

Keith, S. B., 1978, Index of mining properties in Yuma County, Arizona: Arizona Bureau of Geology and Mineral Technology Bulletin 192, 185 p.

_____ 1979, The great southwestern Arizona overthrust oil and gas play: Arizona Bureau of Geology and Mineral Technology Fieldnotes v. 9, no. 1, p. 10-14.

Kreidler, T. J., 1986, Mineral investigation of a part of the Cactus Plain Wilderness Study Area (AZ-050-014A/B), La Paz County, Arizona: U.S. Bureau of Mines Open-file Report MLA 64-86, 11 p.

_____ 1987, Mineral investigation of the East Cactus Plain Wilderness Study Area (AZ-050-017), La Paz County, Arizona: U.S. Bureau of Mines Open-file Report MLA 81-87, 10 p.

Lehman, N. E., Spencer, J. E., and Welty, J. W., 1987, Middle Tertiary mineralization related to metamorphic core complexes and detachment faults in Arizona and California: Society of Mining Engineers Preprint Number 87-21, 9 p.

Levinson, A. A., 1980, Introduction to exploration geochemistry: Wilmette, Illinois, Applied Publishing, 924 p.

Reynolds, S. J., 1980, Geologic framework of west-central Arizona: Arizona Geological Society Digest, v. 12, p. 1-16.

Ryder, R. T., 1983, Petroleum potential of wilderness lands in Arizona; in Miller, B. W. ed., Petroleum potential of wilderness lands in the western United States: U.S. Geological Survey Circular 902 A-P, p. C1-C22.

Spencer, J. E., Reynolds, S. J., and Lehman, N. E., 1986, Geologic map of the Planet-Mineral Hill area, northwestern Buckskin Mountains, west-central Arizona: Arizona Bureau of Geology and Mineral Technology Open-file Report 86-9, scale, 1:24,000, and pamphlet, 13 p.

Spencer, J. E., and Welty, J. W., 1985, Reconnaissance geology of mineralized areas in parts of the Buckskin, Rawhide, McCracken and northeast Harcuvar Mountains, western Arizona: Arizona Bureau of Geology and Mineral Technology Open-file Report 85-6, 31 p.

Spencer, J. E., and Welty, J. W., 1986, Possible controls of base- and precious-metal mineralization associated with Tertiary detachment faults in the lower Colorado trough, Arizona and California: Geology, v. 14, p. 195-198.

Witcher, J. C., Stone, Claudia, and Hahman, W. R., Sr., 1982, Geothermal resources of Arizona: Arizona Bureau of Geology and Mineral Technology Map, scale 1:500,000.

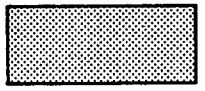
Wilkins, Joe, Jr., Beane, R. E., and Heidrick, T. L., 1986, Mineralization related to detachment faults: a model: Arizona Geological Society Digest v. 16, p. 108-117.

Wilkins, Joe, Jr., and Heidrick, T. L., 1982, Base- and precious-metal mineralization related to low-angle tectonic features in the Whipple Mountains, California and Buckskin Mountains, Arizona; in, Frost, E. G., and Martin, D. L., eds., Mesozoic-Cenozoic tectonic evolution of the Colorado River region, California, Arizona, and Nevada; the Anderson-Hamilton Volume: San Diego, California, Cordilleran Publishers, p. 182-203.

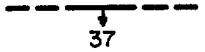
Wodzicki, Antoni, Krason, Jan, and Cruver, S. K., 1982, Geology, energy, and mineral resources assessment of the Bill Williams area, Arizona: Geoexplorers International, Inc., Denver, CO, prepared for the Bureau of Land Management, 130 p.

EXPLANATION OF SYMBOLS FOR FIGURES 3-10

APPROXIMATE BOUNDARY OF THE PLANET PEAK STUDY AREA



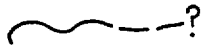
UNPATENTED MINING CLAIMS



FAULT--Showing strike and dip; dashed where approximate

FAULT ZONE

BUCKSKIN-RAWHIDE DETACHMENT FAULT--Showing strike and dip; dashed where concealed; hachures on upper plate. (Spencer and others, 1986)



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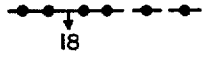
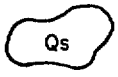


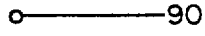
VEIN--Showing strike and dip; dashed where approximate



QUATERNARY SURFICIAL DEPOSITS

CARBONATES AND METACARBONATES--Local sandstone

GNEISS--Locally mylonitic

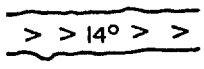


SAMPLE LOCALITY--Showing sample number

OPENCUT OR PORTAL

SHAFT EXTENDING THROUGH LEVEL

CROSSCUT IN VERTICAL SECTION

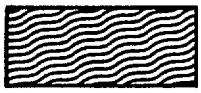


INCLINED WORKINGS--Showing degree of inclination; chevrons pointing down

VOLCANIC ROCK

EXPLANATION OF SYMBOLS FOR FIGURES 3-10--Continued

BRECCIA

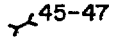


MYLONITIC GNEISS

GRANITIC GNEISS

HIGHLY-ALTERED MAFIC ROCK

SURFACE OPENINGS--Showing sample number(s)



Trench or opencut

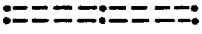
Adit

Shaft

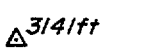
Prospect pit

IMPROVED ROAD

UNIMPROVED ROAD



TRANSMISSION LINE

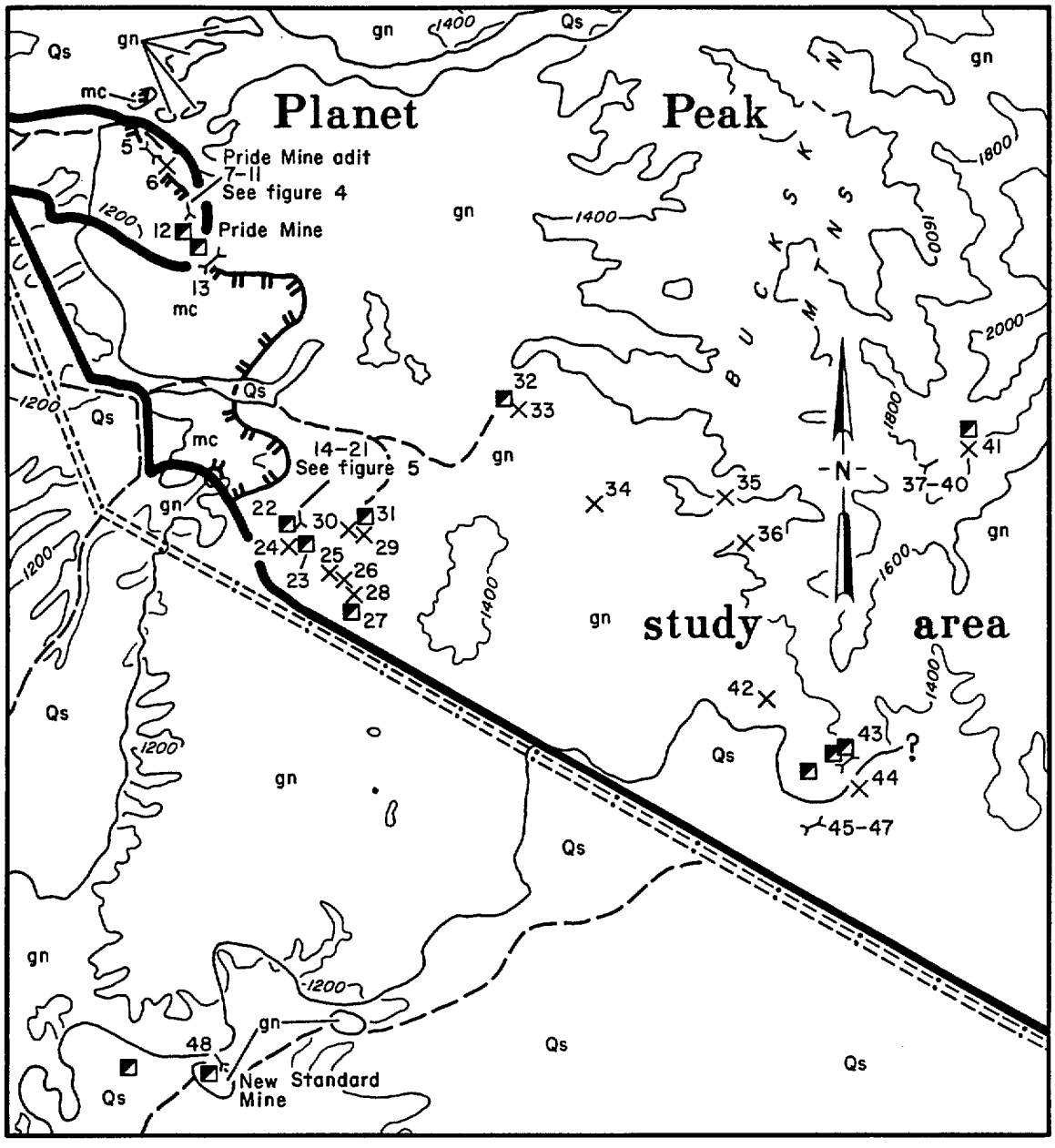


HORIZONTAL CONTROL STATION--Showing elevation in feet above sea level

SPOT ELEVATION--Showing feet above sea level

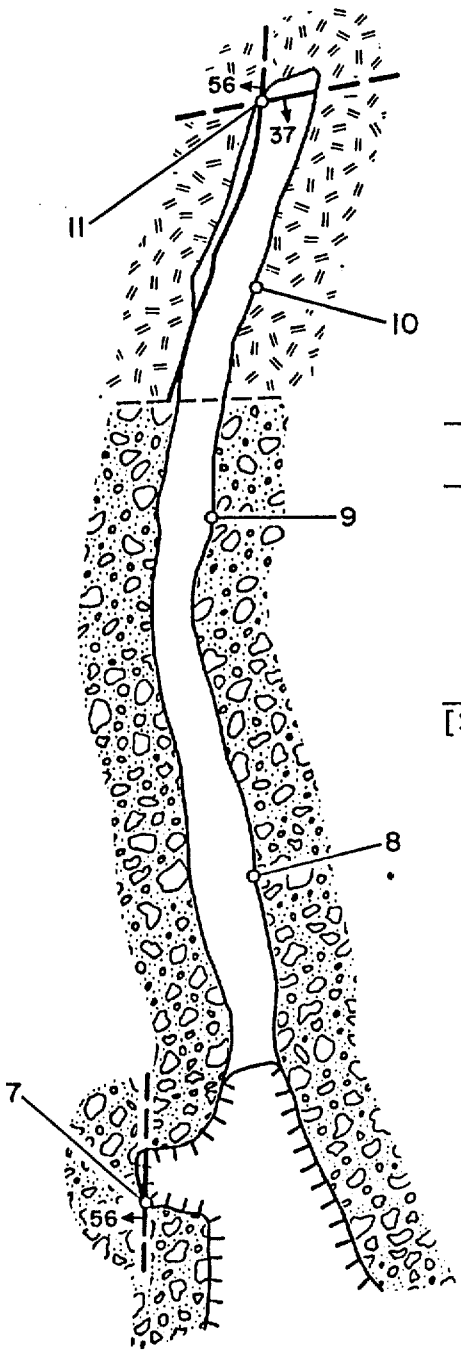
TOPOGRAPHIC CONTOUR--Showing elevation in feet above sea level

INTERMITTENT STREAM



Geology from Spencer and others, 1986.

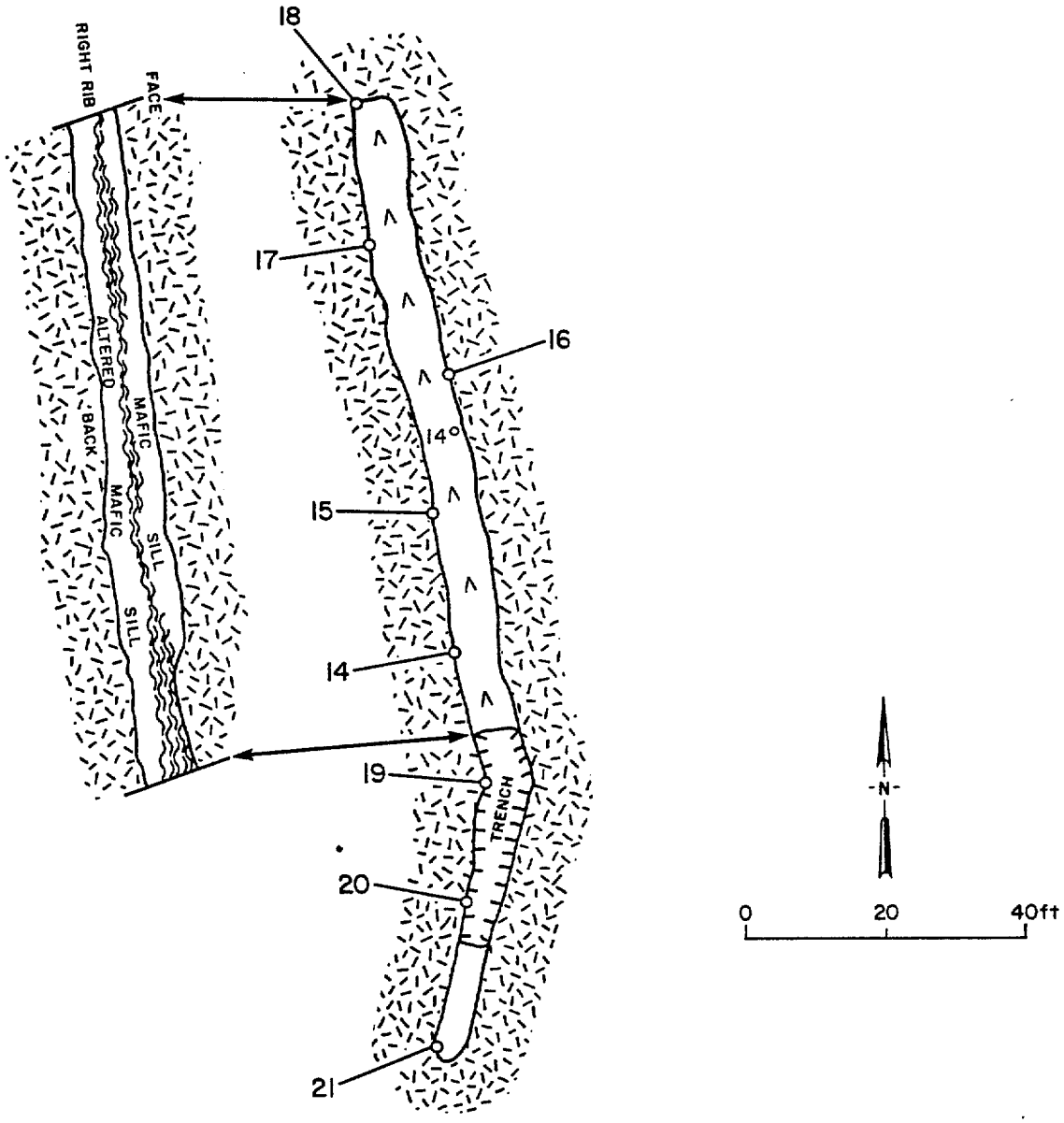
Figure 3.--The Pride Mine area.



Sample no.	length of chip (in.)	Au ppb	Cu %	Fe %
7	24	<5	0.1	10.0
8	36	<5	.2	17.0
9	44	11	.73	32.0
10	48	29	.26	16.0
11	36	<5	tr	3.2

[Symbols used: <, less than; tr, trace.]

Figure 4.--Pride Mine adit; table shows sample data.



Sample no.	length of chip (in.)	Au ppb	Cu %	Fe %
14	48	<5	0.3	38.0
15	24	<5	.084	19.0
16	11	<5	.133	17.0
17	27	<5	.11	7.8
18	32	<5	.02	4.4
19	30	8	.38	37.0
20	60	<5	1.1	31.0
21	65	10	1.15	11.0

[Symbol used: <, less than.]

Figure 5.--Adit in sec. 4, T. 9 N., R. 17 W.; table shows sample data.

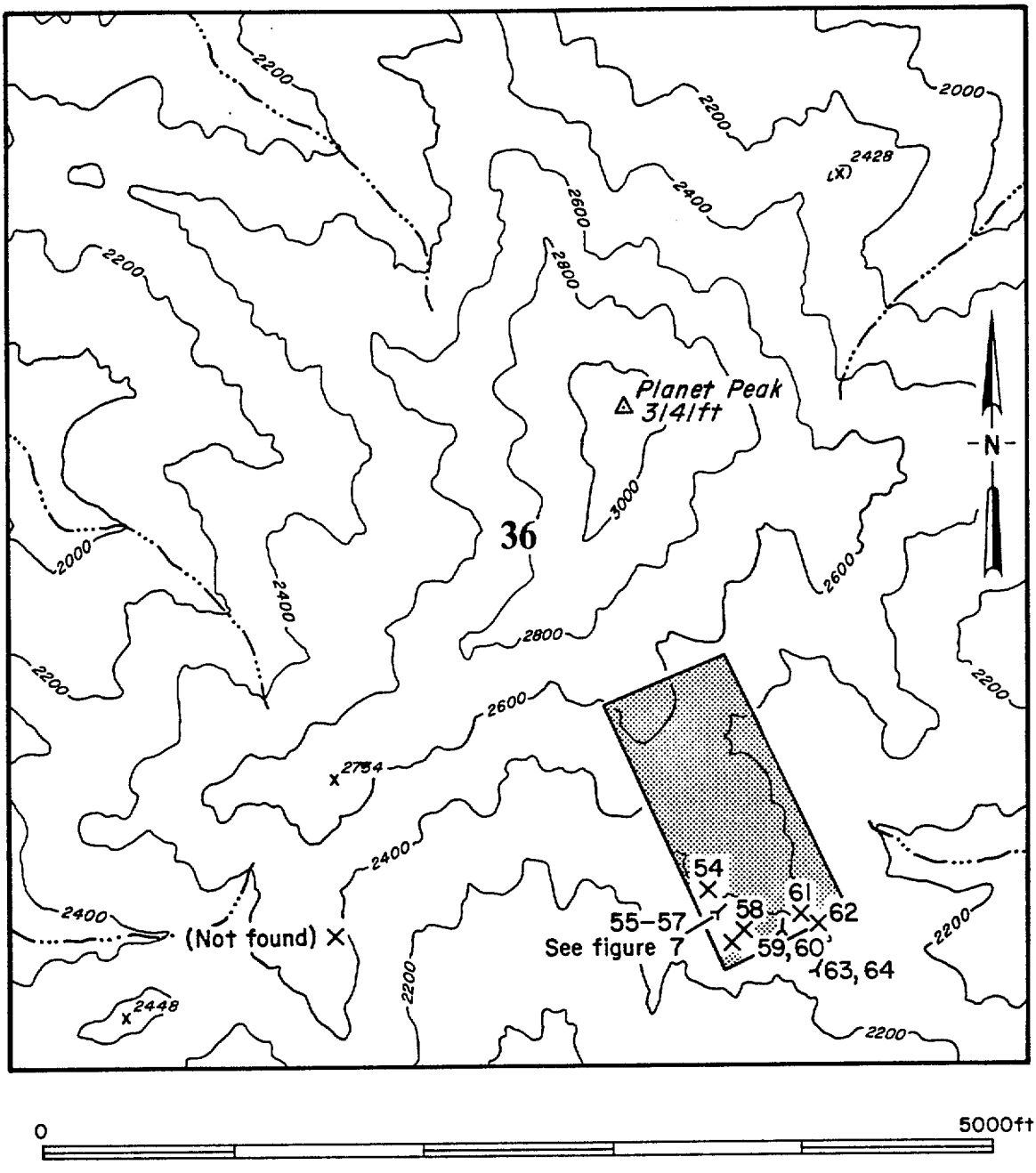
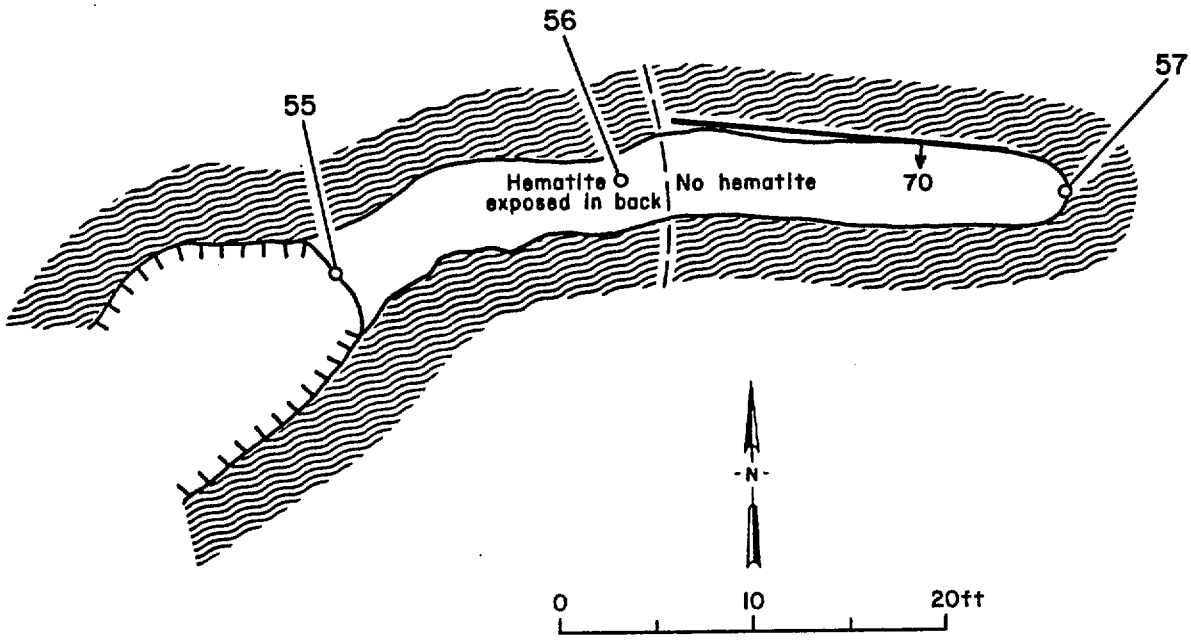


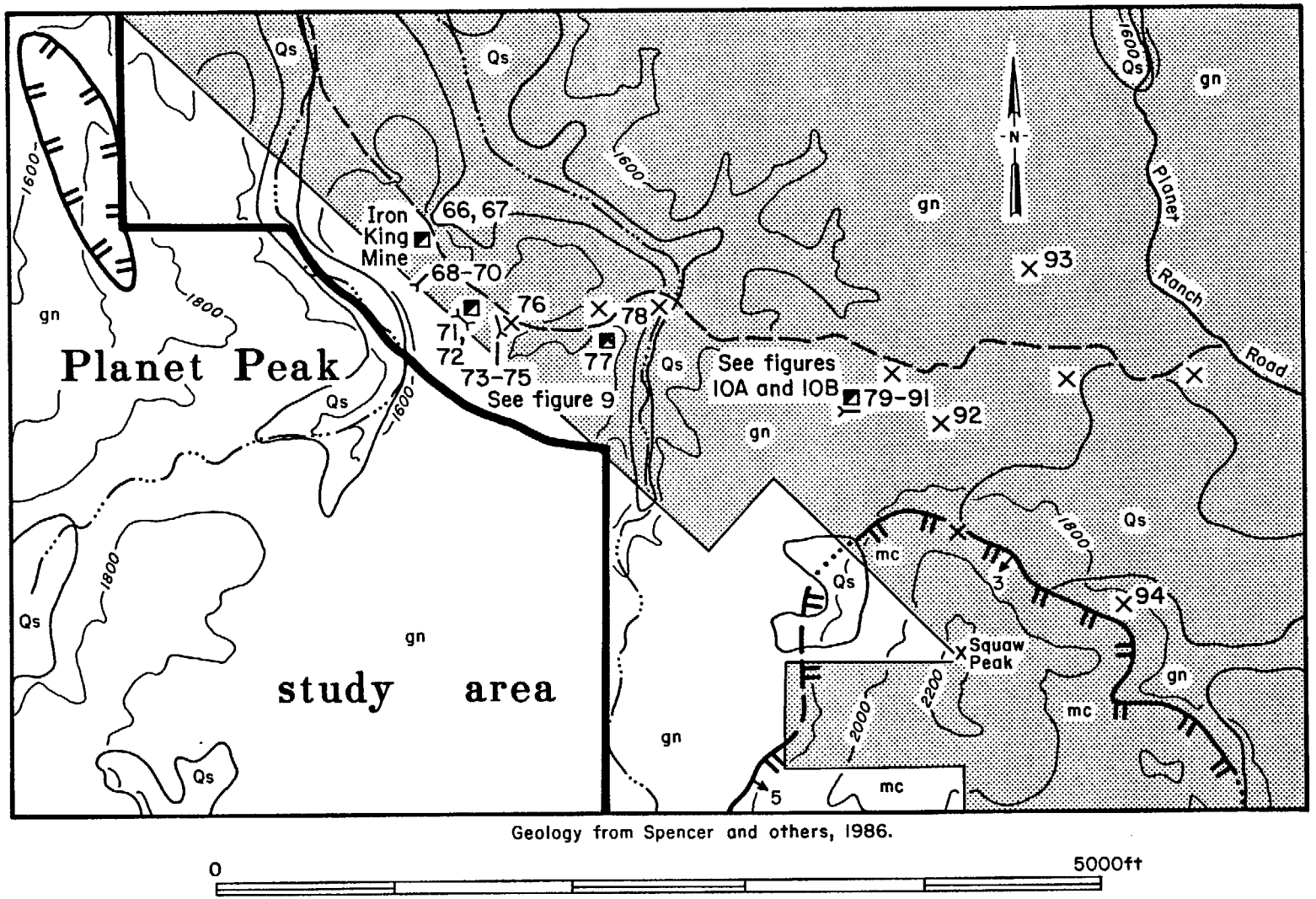
Figure 6.--Prospects near Planet Peak.



Sample no.	length of chip (in.)	Au ppb	Cu %	Fe %
55	36	17	3.2	42.0
56	36	8	.44	50.5
57	40	<5	tr	9.2

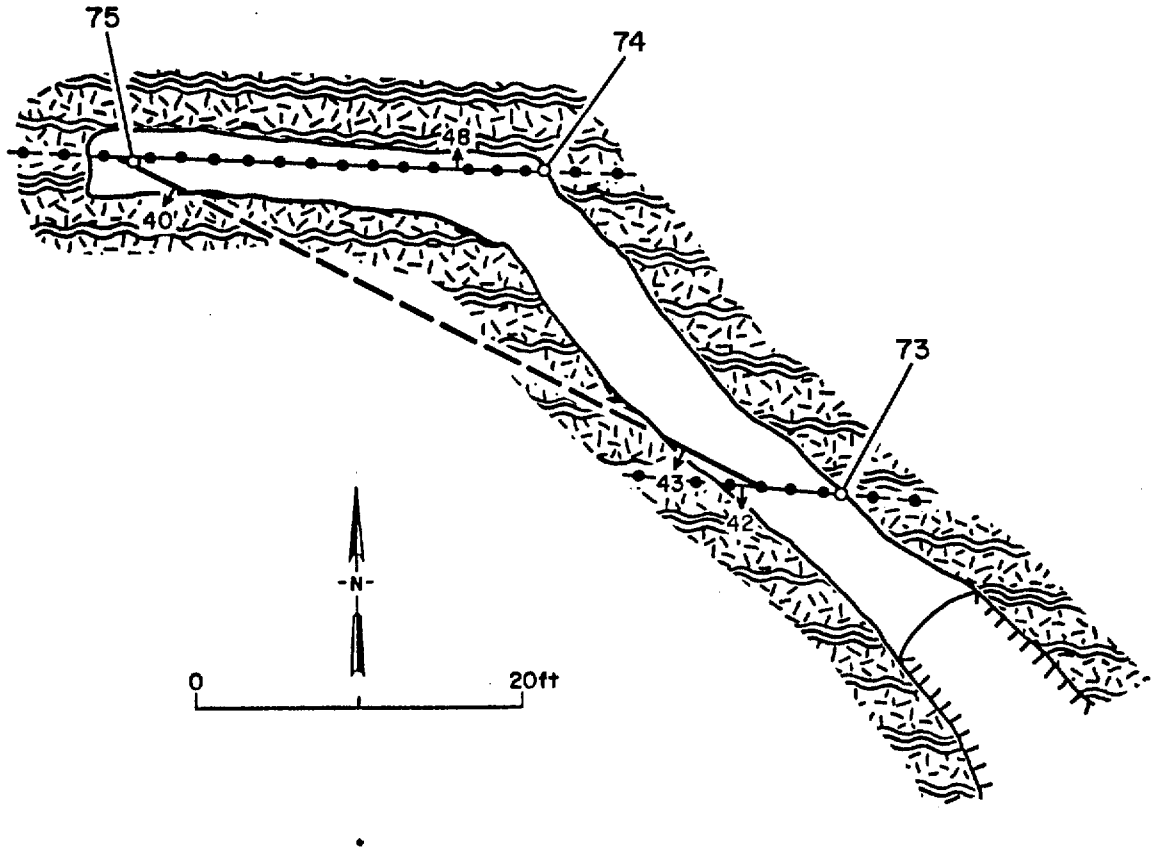
[Symbols used: <, less than; tr, trace.]

Figure 7.--Adit near Planet Peak; table shows sample data.



Geology from Spencer and others, 1986.

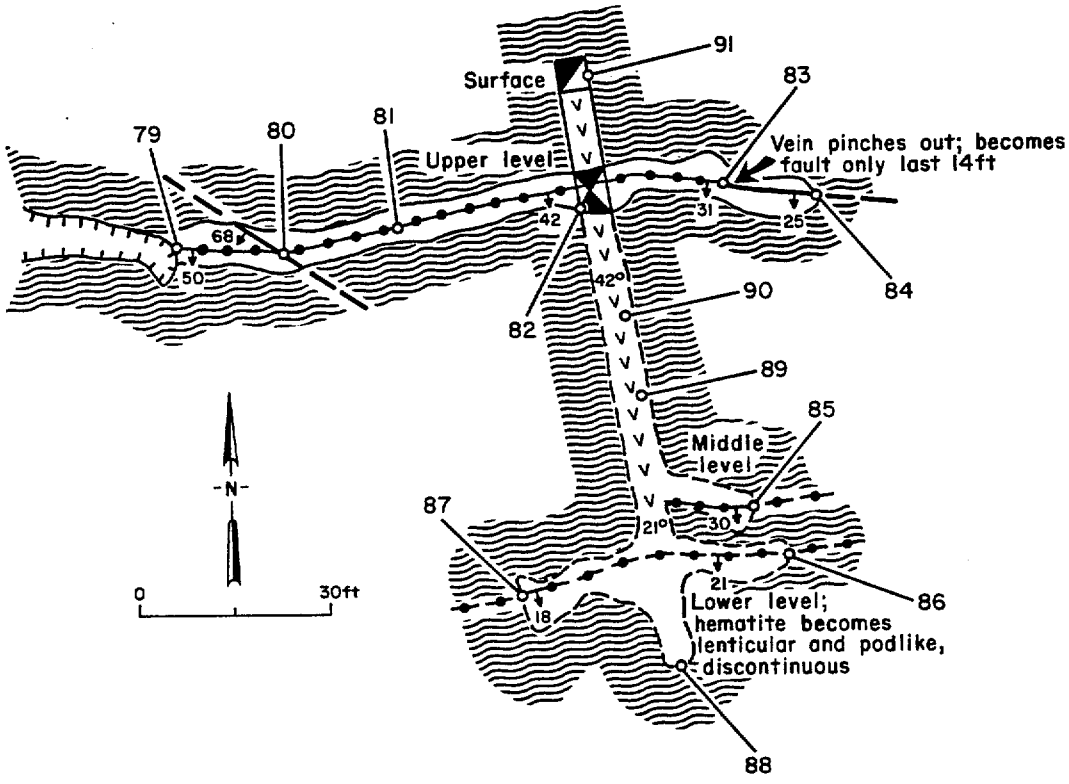
Figure 8.--Workings in the Squaw Peak area.

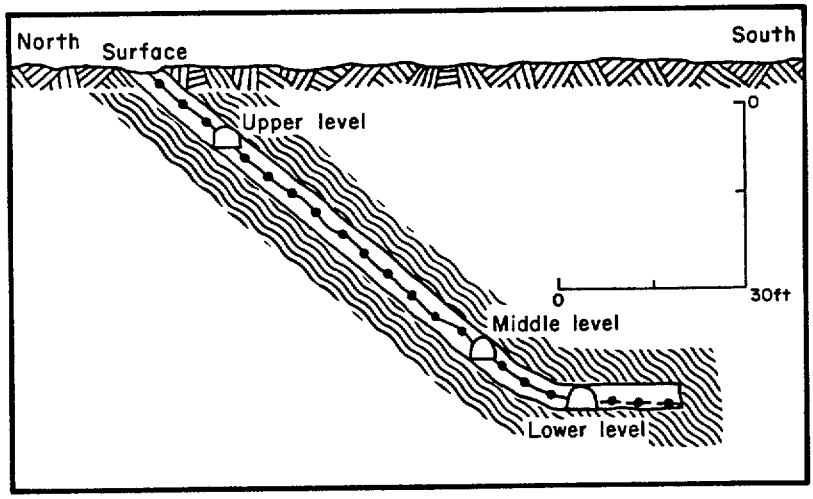


Sample no.	length of chip (in.)	Au ppb	Cu %	Fe %
73	23	<5	0.5	41.0
74	12	<5	.2	6.4
75	30	<5	.144	17.0

[Symbol used: <, less than.]

Figure 9.--Adit in Squaw Peak area; table shows sample data.





Cross-section sketch

Figure 10.--Adit and decline in the Squaw Peak area.

Table 2.--Data for samples from the Pride Mine area not shown on figures.

[Detection limits: gold (Au), 5 ppb; copper (Cu), 0.0001%; iron (Fe), 0.5%; symbols used: <, less than; tr, element detected in trace levels only. All are chip samples unless otherwise noted.]

Sample no.	Sample length (in.)	Au ppb	Cu %	Fe %	Description
5	50	150	0.77	39.0	Opencut; possible exposure of Buckskin-Rawhide detachment fault; massive hematite and secondary copper minerals in complex of felsic rocks and limestone, mostly unrecognizable; chloritized, and silicified.
6	54	35	.78	39.0	Pit; copper minerals on fracture surfaces in chloritized and silicified rock, may be mafic rock or limestone.
12	66	23	1.3	29.0	Shaft; hematite and copper minerals in fault breccia in same rock as sample 6; breccia contains fragments of limestone, mafic, and felsic rock; strikes N. 10° E., dips 48° NW.
13	120	89	1.2	49.0	Trench; hematite pod, chrysocolla-azurite on fractures, in mylonitic granitic gneiss capped by limestone; strikes N. 20° E., dips vertical.
22	grab	<5	.048	5.5	Shaft, about 100 ft deep; mylonitic granitic gneiss, minor pyrite pseudomorphs, no hematite or copper minerals.
23	select	12	1.5	35.0	Shaft, about 50 ft deep; massive hematite and moderately abundant malachite-azurite.
24	20	9	1.1	42.0	Pit; hematite lens in altered mafic rock.
25	44	6	.44	7.9	Pit; hematite stringers and veinlets in altered gneiss; secondary copper minerals, partly epidotized.
26	36	11	.66	21.0	Pit; hematite and crysocolla-malachite in two intersecting faults striking N. 45° W. and N. 30° W., dipping vertically and variably, respectively; granitic gneiss.

Table 2.--Data for samples from the Pride Mine area not shown on figures--Continued

Sample no.	Sample length (in.)	Au ppb	Cu %	Fe %	Description
27	grab	<5	tr	2.2	Shaft; mylonitic granitic gneiss, minor limonite staining and pyrite pseudomorphs; possibly on nearly horizontal fault.
28	48	8	1.1	4.0	Pit; malachite-azurite on surfaces in fault zone, strikes N. 40° W., dips 40° NE.; hematite abundant on dump, but none is visible in place, indicating a small pod.
29	60	350	.2	15.0	Pit; hematite stringers and veinlets and malachite-azurite in brecciated mylonitic gneiss at intersecting faults striking N. 65° W. and N. 30° W., dipping 66° SW. and variably, respectively.
30	48	<5	.54	8.6	Pit; abundant malachite-azurite and minor fingernail-sized hematite blebs in brecciated mylonitic gneiss; fault strikess N. 60° W., dips vertical.
31	grab	<5	.031	5.3	Shaft, 57 ft deep; altered, chloritized gneiss; minor hematite stringers; surface area around shaft and sites 29 and 30 is covered with hematite float, but none appears in the workings below the surface.
32	select	<5	tr	10.0	Shaft; hematite pods in brecciated mylonitic gneiss.
33	24	<5	.013	62.7	Pit; small hematite pod, <3 ft thick; brecciated mylonitic gneiss.
34	24	23	.9	23.0	Pit; hematite lens, about 5.5 ft thick, in brecciated mylonitic gneiss; abundant malachite-azurite on fracture surfaces.
35	select	<5	.028	14.0	Pit; minor stringers of hematite in mylonitic gneiss; slightly chloritized.
36	15	<5	.168	14.0	Pit; hematite stringers and veinlets in epidotized gneiss.

Table 2.--Data for samples from the Pride Mine area not shown on figures--Continued

Sample no.	Sample length (in.)	Au ppb	Cu %	Fe %	Description
37	12	10	0.26	10.0	Adit; nearly horizontal slip surface; chloritized mafic rock overlying mylonitic granitic gneiss; abundant red hematite staining, minor malachite-azurite, pyrite pseudomorphs.
38	15	<5	.02	10.0	Adit; brecciated gneiss in fault, strikes N. 50° W., dips variably; 12-in.-wide hematite veinlet, pyrite pseudomorphs.
39	15	<5	tr	5.1	Adit; brecciated gneiss in fault, strikes N. 57° W., dips 55° NE.; pyrite pseudomorphs.
40	12	<5	tr	9.2	Adit; brecciated gneiss in fault, strikes N. 50° W., dips variably; pyrite pseudomorphs, possibly some hematite on fracture surfaces.
41	37	6	.64	46.0	Pit; hematite lens in gneiss; malachite-azurite on fracture surfaces.
42	grab	<5	tr	4.0	Pit; granitic gneiss.
43	grab	7	1.08	45.0	Trench; flat-lying hematite pod, not more than 5 ft thick.
44	select	7	.74	33.0	Pit; hematite pod in granitic gneiss; malachite-azurite on fracture surfaces.
45	26	7	tr	8.0	Trench; altered diabase dike in fault, strikes N. 15° E., dips 55° NW.; minor malachite-azurite on fracture surfaces.
46	18	<5	.071	18.0	Trench; green, clayey gouge in shear zone.
47	30	<5	.13	11.0	Trench; silicified mafic dike in shear zone; abundant hematite and malachite-azurite.
48	40	22	1.75	59.6	New Standard Mine; massive hematite lens in brecciated gneiss and a mafic dike; abundant malachite-azurite on all fracture surfaces.

Table 3.--Data for samples from the Planet Peak area not shown on figures.

[Detection limits: gold (Au), 5 ppb; copper (Cu), 0.0001%; iron (Fe), 0.5%; symbols used: <, less than; tr, element detected in trace levels only. All are chip samples unless otherwise noted.]

Sample no.	Sample length (in.)	Au ppb	Cu %	Fe %	Description
54	84	<5	0.66	58.7	Pit; hematite lens in highly altered diabase(?) dike; chloritized, malachite-azurite on fracture surfaces.
58	40	<5	.02	18.0	Pit; 8-in.-wide hematite vein in complex structural contact with altered mafic rock and mylonitic gneiss.
59	27	<5	.075	21.0	Adit, hematite pod in granitic gneiss; abundant malachite-azurite.
60	30	9	3.04	38.0	Do.
61	select	7	3.76	40.0	Pit; hematite pod, about 35x30x7 ft; abundant malachite-azurite.
62	19	<5	.145	48.0	Pit; 15-in.-wide hematite vein along limestone-mylonitic gneiss contact, strikes N. 45° E., dips 66° NW.
63	31	20	tr	1.9	Adit; mylonitic gneiss.
64	24	<5	.25	29.0	Adit; limestone and mafic rock in fault contact; hematite pods in mafic, sparse chrysocolla and malachite.

Table 4.--Data for samples from an adit and decline in the Squaw Peak area.

[Detection limits: gold (Au), 5 ppb; copper (Cu), 0.0001%; iron (Fe), 0.5%; symbols used: <, less than; tr, element detected in trace levels only; ---, not applicable. All are chip samples unless otherwise noted.]

Sample no.	Sample length (in.)	Au ppb	Cu %	Fe %	Description
79	48	<5	0.54	31.0	Rust-colored hematite vein (40 in. wide) in fault in mylontic gneiss; strikes N. 65° E., dips 50° SE.; chalcopyrite, bornite, and secondary copper minerals on fracture surfaces.
80	48	<5	.44	41.0	Do.
81	38	<5	1.3	26.0	Do.
82	48	9	1.0	9.2	Do.
83	24	<5	.064	22.0	Hematite vein thins to 12 in.
84	30	<5	.066	15.0	Hematite pinches out.
85	42	13	1.48	51.2	Hematite vein (30 in. wide); abundant secondary copper minerals on fracture surfaces.
86	48	<5	.085	22.0	Hematite pods, vein is discontinuous.
87	30	10	1.05	29.0	Do.
88	36	<5	.105	23.0	Hematite pods as thick as 6 in.
89	36	<5	.32	38.0	Hematite pods, no vein at this point.
90	60	<5	.07	14.0	Hematite vein contains pods and lenses of altered, weathered gneiss.
91	---	24	4.08	32.0	Select sample from stockpile at shaft collar; massive hematite, minor secondary copper minerals.

Table 5.--Data for samples from the Squaw Peak area not shown on figures or other tables.

[Detection limits: gold (Au), 5 ppb; copper (Cu), 0.0001%; iron (Fe), 0.5%; symbols used: <, less than; tr, element detected in trace levels only. All are chip samples unless otherwise noted.]

Sample no.	Sample length (in.)	Au ppb	Cu %	Fe %	Description
66	35	<5	0.64	54.0	Prospect shaft adjacent to Iron King Mine; hematite in fault in gneiss, minor calcite.
67	36	<5	.45	62.9	Do.
68	27	<5	tr	4.0	Adit, unmineralized crosscut, at portal; granitic gneiss, unaltered.
69	12	10	.038	11.0	Adit, portal +171 ft; altered mafic dike in fault; strikes N. 60° W., dips 65° NE.
70	36	<5	tr	6.3	Adit, at face; unaltered diabase dike in granitic gneiss.
71	28	<5	.74	55.9	Trench in granitic gneiss; 9.5-ft-wide fault zone, crumbly hematite; strikes N. 50° W., dips 45° NE.
72	84	<5	.51	44.0	Do.
76	36	<5	.46	25.0	Pit; fault, strikes W., dips vertical; hematite veinlets and pods.
77	40	<5	.26	65.8	Shaft; 40-in.-wide hematite vein in fault in granitic gneiss; strikes N. 80° W., dips 55° SW., sparse malachite-azurite.
78	28	<5	.078	60.4	Pit; highly brecciated, crumbly hematite; minor malachite-azurite, local quartz-crystal-filled vugs.
92	20	<5	tr	4.4	Pit; fault in mylonitic granitic gneiss, strikes N. 35° E., dips 30° SE.; limonite staining.
93	60	<5	tr	18.0	Pit; gneiss, alternating bands of felsic minerals and hematite; rock foliation strikes N. 70° W., dips 70° NE.
94	dump	<5	tr	2.6	Pit; red, hematite-stained granitic gneiss.

Table 6.--Data for miscellaneous samples from the Planet Peak study area, Arizona.

[Detection limits: gold (Au), 5 ppb; copper (Cu), 0.0001%; iron (Fe), 0.5%; symbols used: <, less than; tr, element detected in trace levels only. All are chip samples unless otherwise noted.]

Sample no.	Sample length (in.)	Au ppb	Cu %	Fe %	Description
1	40	12	0.58	22.0	Adit; 6-in.-wide hematite vein in weathered volcanic rock, dark green to gray-green; malachite-azurite on fracture surfaces.
2	48	6	.96	22.0	Do.
3	36	<5	.34	14.0	Do.
4	48	<5	tr	1.9	Pit; fault gouge in brown limestone; hematite and chrysocolla on dump, none in pit.
49	44	12	.61	13.0	Pit; limestone underlain by epidotized dike in turn underlain by mylonitic gneiss; local malachite-azurite; sample primarily epidote.
50	32	7	.38	40.0	Pit; 11-in.-wide hematite vein in granitic gneiss, strikes N. 50° E., dips 66° SE.; epidote, malachite-azurite.
51	42	50	2.24	34.0	Pit; fault breccia, strikes N. 10° W., dips 76° NE.; abundant malachite-azurite, epidote, minor hematite pods.
52	14	<5	tr	2.6	Pit; unaltered mylonitic gneiss.
53	36	8	4.56	17.0	Pit; hematite in fault, strikes N. 20° E., dips nearly horizontal; limestone in hanging wall, mylonitic gneiss in footwall; malachite-azurite on fracture surfaces.
65	15	<5	tr	2.0	Pit; unmineralized fault in mylonitic gneiss, strikes N. 70° W., dips 75° SW.

United States Department of the Interior

BUREAU OF MINES

P. O. BOX 25086
BUILDING 20, DENVER FEDERAL CENTER
DENVER, COLORADO 80225

Intermountain Field Operations Center

May 31, 1989

Leroy Kissinger, Director
Arizona Department of Mines
& Mineral Research
Mining Building
State Fairgrounds
Phoenix, AZ 85007

Dear Mr. Kissinger:

Enclosed is a copy of each of the following U.S. Bureau of Mines Open-File Reports:

MLA 1-89 MINERAL RESOURCES OF THE BLACK MOUNTAINS NORTH (AZ-020-009), AND BURNS SPRING (AZ-020-010) WILDERNESS STUDY AREAS, MOHAVE COUNTY, ARIZONA

MLA 9-89 MINERAL INVESTIGATION OF A PART OF THE PLANET PEAK WILDERNESS STUDY AREA (AZ-050-013), LA PAZ COUNTY, ARIZONA

Sincerely,

Uldis Jansons

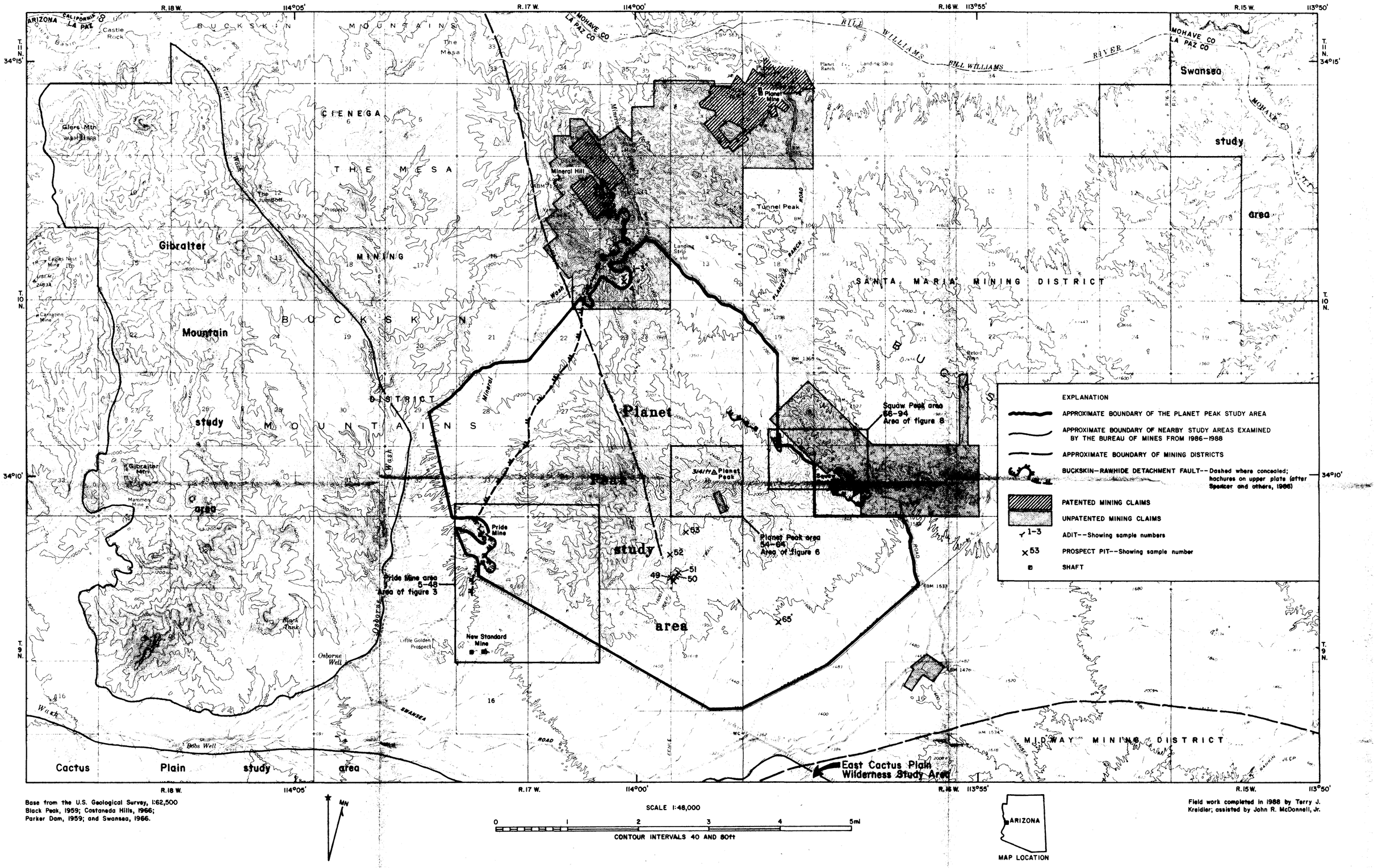
Uldis Jansons, Chief
RE Branch

Enclosure(s)
(listed above)

cc: Project File

DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

OPEN FILE REPORT
MLA 9-89
PLATE 1



EXPLANATION

- APPROXIMATE BOUNDARY OF THE PLANET PEAK STUDY AREA
- APPROXIMATE BOUNDARY OF NEARBY STUDY AREAS EXAMINED BY THE BUREAU OF MINES FROM 1986–1988
- APPROXIMATE BOUNDARY OF MINING DISTRICTS
- BUCKSKIN–RAWHIDE DETACHMENT FAULT--Dashed where concealed; hachures on upper plate (after Spencer and others, 1988)
- PATENTED MINING CLAIMS
- UNPATENTED MINING CLAIMS
- 1-3 ADIT--Showing sample numbers
- ×53 PROSPECT PIT--Showing sample number
- SHAFT

MINE AND PROSPECT MAP OF THE PLANET PEAK STUDY AREA, LA PAZ COUNTY, ARIZONA

BY

TERRY J. KREIDLER, U.S. BUREAU OF MINES

1989